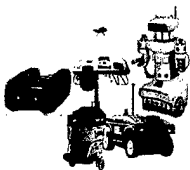


REPORT DOCUMENTATION PAGE				Form Approved OMB No. 0704-01-0188	
<p>The public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing the burden to Department of Defense, Washington Headquarters Services Directorate for Information Operations and Reports (0704-0188), 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.</p> <p>PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.</p>					
1. REPORT DATE (DD-MM-YYYY) 31-12-2001		2. REPORT TYPE Special Document		3. DATES COVERED (From - To)	
4. TITLE AND SUBTITLE ROBOTICS UPDATE "Providing network-integrated robotic solutions for C4ISR applications"				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHORS Everett, Bart				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Space and Naval Warfare Systems Center 53560 Hull Street San Diego, CA 92152-5001				8. PERFORMING ORGANIZATION REPORT NUMBER SD 403	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution is unlimited.					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT <div style="text-align: right; font-size: 2em; font-weight: bold; margin-top: 20px;">20020307 128</div> ROBOTICS UPDATE, Vol. 1, No. 2, 31 December 2001.					
15. SUBJECT TERMS C4ISR Robotics					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			Bart Everett, D3701
U	U	U	UU	2	19b. TELEPHONE NUMBER (Include area code) (619) 553-3672



ROBOTICS UPDATE

"Providing network-integrated robotic solutions for C4ISR applications."

www.spawar.navy.mil/robots/

31 December 2001 / Vol. 1, No. 2

SSC San Diego Robots Assist New York City Rescue Effort

On 13 September, Bart Everett, Associate Division Head for Robotics, along with Mike Bruch and Robin Laird, members of the Robotic Systems Branch, traveled to New York City in support of the Center for Robotic Assisted Search and Rescue (CRASAR), directed by Lt. Col. John Blitch. They brought three *URBOTs* (Urban Robots) that were being developed under the Man Portable Robotic System program, sponsored by the US Army/Marine Corps Unmanned Ground Vehicle/Systems Joint Program Office.

The *URBOTs* are based upon the six-wheel Foster-Miller Tactical Adjustable Robot (TAR). SSC San Diego outfitted these platforms with upgraded electronics, a fully integrated digital communications link for video, bi-directional audio, and command data, four cameras with dual halogen headlights, and a wearable Operator Control Unit. The *URBOT* is fully invertible,



Bart Everett and Mike Bruch
in front of the ruins of
World Trade Center Tower 2

with an attitude sensor automatically determining which video camera to use in case the robot flips over. Transparent to the operator, onboard software also inverts the sense of incoming drive and steering commands to preserve a normal mobility response.

Operators from other organizations supporting CRASAR (Foster-Miller, iRobot, and the

University of South Florida) used smaller vehicles, primarily the *SOLEM* and an Inuktun *Vari-Track*, to travel down access shafts and identify areas where victims were located. The somewhat larger *URBOTs*, more suited for structural damage assessment missions in the outlying buildings surrounding the pile, were able to penetrate into the Marriott from the south, east, and north sides, one block south of the World Trade Center 2.



URBOT performing structural
damage assessment on 9/15/01

Following this week-long rescue assist to NYC, attention shifted quickly back to the tactical applications for which the *URBOT*

was initially designed. A new tandem drive configuration concept is under development, which allows two robots to be driven to the same destination by a single operator, with the added benefit of enhanced breaching capability in rough terrain. The robots can be remotely decoupled at the appropriate time, allowing one to remain stationary as an RF relay node, preserving non-line-of-sight communications with the second unit as it enters a cave or tunnel complex.



Cooperative mobility concept
employing tandem drive for
enhanced breaching capability

Marines Tour D371 During SSC San Diego's Marine Corps Day

The first Marine Corps Day was held at SSC San Diego Oct. 29-30 in partnership with SPAWAR Headquarters and the First Marine Expeditionary Force (IMEF). The two-day event showcased the Center's advanced command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR) technologies. Center presentations and demonstrations were directed at Marine Corps doctrine and operations. They highlighted science and technology programs, as well as new and emerging systems.

Lt. Gen. Michael Hagee, Commanding General, IMEF, was the keynote speaker, and over 100 attendees from 14 Navy and Marine Corps organizations visited the Center.

The Robotic Systems Branch participated by providing a branch overview presentation, followed by a warfighting demonstration involving the MDARS Interior and Exterior, *URBOT*, and *ROBART III* platforms. After the demonstrations, members of the Marine Corps community expressed a desire to increase efforts aimed at collaboration.



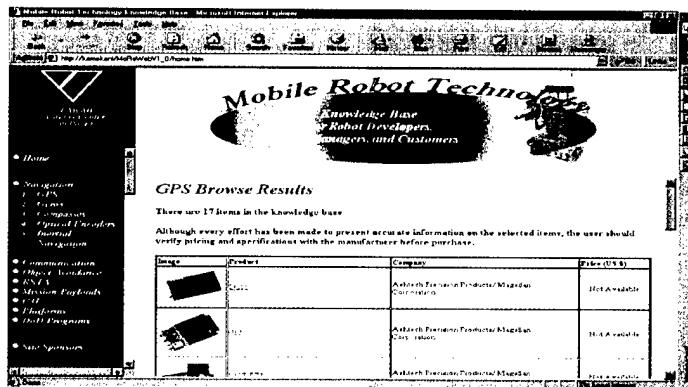
Bart Everett demonstrates Robart III to a group of visiting Marines

Mobile Robot Technology Database Launched

The Mobile Robot Technology Knowledge Base will be made available to the public in January by Tracy Heath Pastore, project manager. The purpose of the database is to provide robotic system developers, program managers, and customers with a web-accessible, centralized knowledge resource for mobile robot components, subsystems, mission payloads, and platforms.

The database can be accessed through a link from the SSC San Diego robotics homepage, www.spawar.navy.mil/robots/, and will eventually include technical information on navigation, communication, obstacle avoidance, RSTA, mission payloads, C3I, commercial platforms, and Department of Defense robotic platforms.

This project has several objectives. One is to manage information related to new technologies and facilitate the transfer of these technologies in an environment of rapid expansion.



Screen shot of database search results for GPS components

Another objective is to capture in-house robotics experience and make this available to the greater robotics community. Finally, this project seeks to minimize redundant product research efforts while maximizing efficiency and responsiveness.

The project leveraged the Small Robot Technology Database, developed initially for NAVSEA and available from the Robotics homepage, which supports information queries on small platforms, GPS receivers, and RF

Links. The scope was expanded and the design was updated to ensure robust availability.

The database has a WWW interface which allows users to search and browse the database, organize the data display according to user interests, and access related Department of Defense databases. The interface also has a data submission form for users to contribute to the database. User registration, SSC San Diego robotic links, and feedback forms are also incorporated into the in-

terface. Data collection is ongoing and is focused on sponsor and project needs while expanding to meet community requirements.

The Access database is hosted on a Windows 2000 server and uses MS Internet Information Server (IIS) with Active Server Page (ASP) extensions. The relational design facilitates rapid queries and interrelated data.

Opportunities are available for organizations to sponsor the continued development of this database. The logos of sponsoring organizations will be displayed on the home page with links to their organizations. The main menu of the interface will also contain sponsor links. Sponsors will help guide the direction of Knowledge Base expansion, and will receive recognition as leaders in the robotics community.

For more information, please contact Tracy Heath Pastore, heath@spawar.navy.mil.

Chemical Plume Mapping with an Autonomous Underwater Vehicle

Article contributed by
SSC San Diego D74.

SSC San Diego's Ocean Engineering Division is using a Woods Hole Oceanographic Institution REMUS autonomous underwater vehicle (AUV) for chemical plume mapping in support of the ONR Chemical Sensing in the Marine Environment (CSME) Program. In order to understand plume behavior, an analytical model was constructed and experiments per-

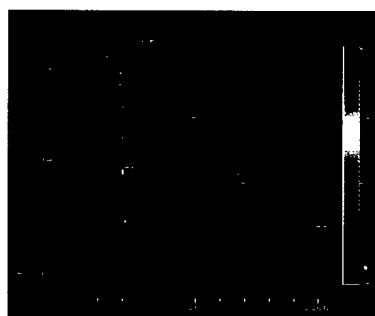
formed using plumes of dye in real-world ocean environments. Measurements are taken using the REMUS vehicle, configured

with a standard suite of sensors and the addition of an upward- and downward-looking acoustic doppler current profiler for velocity field measurements, and a dye fluorometer for dye detection.

Operations held at San Clemente Island in March 2001 focused on operator training and vehicle familiarization. Operations in Duck, NC in May 2001 focused on the collection of plume data. Seventeen missions were run over five days, collecting a wealth of data on the plume behavior. Full-field runs encompassed the full extent of the plume up to 1 km from the source. Near-field runs covered a smaller area multiple times to collect data on the evolution of the plume.

The REMUS AUV has proven to be a useful asset for the collection of chemical plume data. Survey areas can be covered in

less time and with greater resolution than with conventional towed systems. It is a versatile system which has been shown to operate effectively in a variety of environ-



Full-field plume map

ments. Both the system and trained operators are available to support other Center and DoD programs.

This work was performed under Project Elena (Project Manager – Rich Arrieta D742, Project Engineer – Barbara Fletcher D744), the field testing porting of the

ONR CSME program (Dr. Keith Ward, Program Manager).

In addition, all of the operations described were performed by the CSME team of Principal Investigators from SSC San Diego, Arete Associates, Naval Research Laboratory, Thorleaf Research, and Stanford University. Also, the operations could not have been done without the field support from Woods Hole Oceanographic Institution, the SSC San Diego Diving Locker, and the Army Corps of Engineers Field Research Facility at Duck, NC.

**SSC San Diego D371
Robotic Systems Branch
Kathy Mullens**

53406 Woodward Road
San Diego, CA 92152-7383
619.553.3666 (phone)

kmullens@spawar.navy.mil
www.spawar.navy.mil/robots/